Port Finance: Interest Rate Market on Solana

Port Finance brings interest rate markets to Solana. It leverages the high speed and low latency of the Solana blockchain with a product suite that includes variable rate lending, fixed rate lending and interest rate swaps.

Port Finance will take a three-step approach:

- Provide a baseline lending protocol that is similar to Compound and Aave on Ethereum.
- Provide a fixed rate lending protocol that utilises the Serum order book.
- Provide an interest rate swap market that also utilises the Serum order book.

Our focus will be on leveraging the technological advancements on the Solana blockchain and the Serum ecosystem to bring lending products that are difficult to implement on Ethereum.

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1 Variable Rate Lending Protocol

The baseline lending protocol has an implementation similar to Compound Finance on Ethereum with three core features:

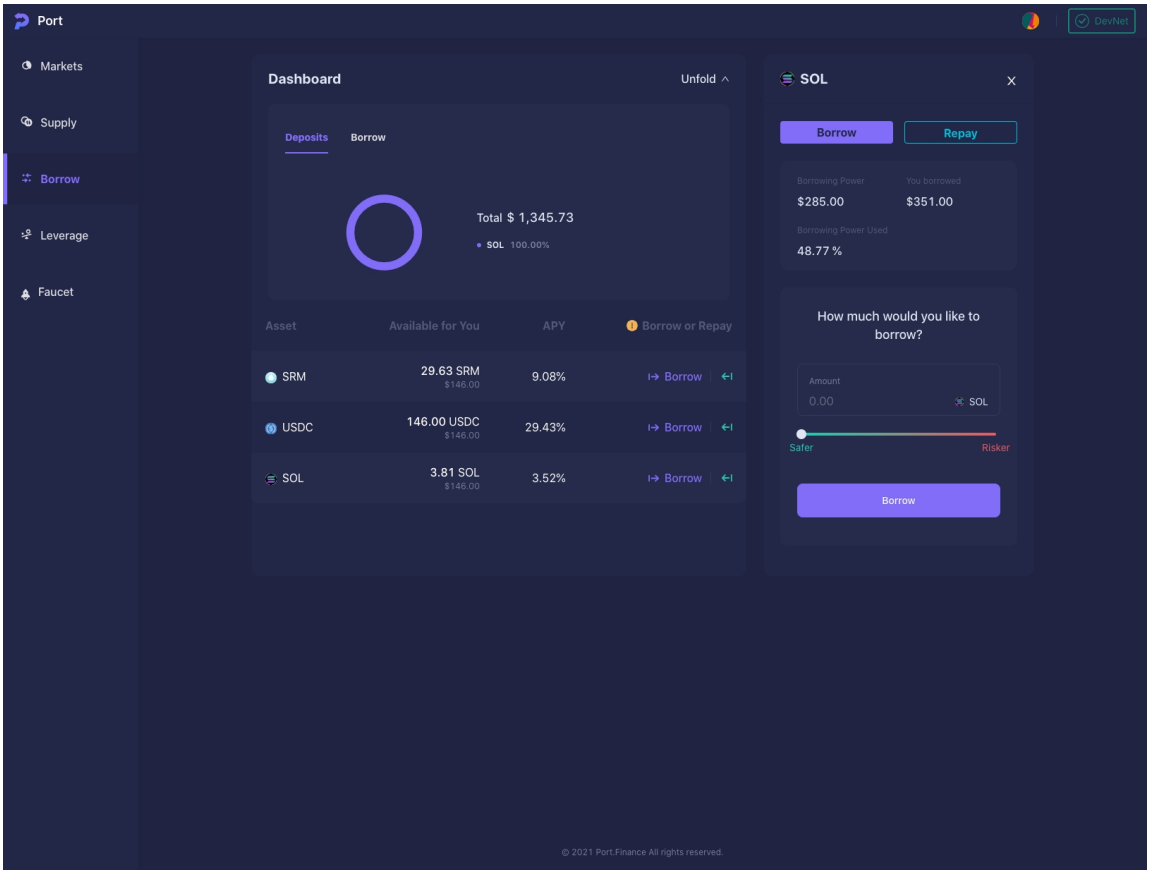
1. Variable rate based on utilization: the interest rate rises with the utilization rate, and vice versa with an adjustable interest rate curve
2. Cross-collateral support: the protocol supports loan origination in various digital assets across multiple collateral options.
3. Flash loans: the protocol supports flash loans, which allow users to perform risk-free arbitrage among different Serum markets or between Serum and Raydium.

Given the speed of the Solana blockchain, Port Finance provides significant advantages compared to current state lending and liquidation on Ethereum. As liquidators can participate in the lending market more efficiently, users on Port Finance may take advantage of a lower collateral ratio (collateral value over loan value), or in other words borrow more against less collateral.

Protocol Parameters

Less Collateral, Lower Liquidation Threshold

Protocol Name	Compound	Aave	Port Finance
Minimum Collateral Ratio	133%	133%	115%
Liquidation Threshold	133%	120%	111% to 105%, depends on the volatility and liquidity
Liquidation Penalty	8%	5-15%	1% to 2 %, depends on the volatility and liquidity
Borrow Fee	5-10% of interest	0.25% of borrowed amount	0.10% of borrowed amount
Flash Loan Fee	N/A	0.30% of total amount	0.10% of the total amount



1.1 Primary Use Cases

The ability to supply assets to earn yield and borrowing assets against existing crypto currency holdings are desirable for:

- Long term SPL token holders who are seeking additional yield
- Traders who are looking for leverage trading

1.2 Borrowing

The total borrowing power of a user is defined as the following:

$$TotalBorrowPower = \Sigma_{collateral} LTV_{collateral} * MarketValue_{collateral}$$

where $MarketValue$ of the collateral is determined by the current price (from Oracle) times the amount of collateral, Loan to Value (LTV) ratio which is a collateral specific based on the volatility and the liquidity of the collateral.

1.3 Liquidation

Liquidation will happen when the price of the collateral decreases or the price of the loan increases. We define the risk factor of a user as the following:

$$RiskFactor = \frac{\Sigma_{borrow} MarketValue_{borrow}}{\Sigma_{collateral} LiquidationThreshold_{collateral} * MarketValue_{collateral}}$$

where $LiquidationThreshold$ is a collateral specific value based on the volatility and liquidity of the collateral. Once the risk factor has reached or exceeds **100%** the user's loan is subject to liquidation.

The liquidator are incentivised to come in and liquidate the users loan because they will be able to earn a $LiquidationBonus$ percentage **more** than what it has paid on behalf of the users.

1.4 Interest Rate Model

The interest rate of the protocol is determined by the utilization rate which is defined as:

$$Utilisation = \frac{TotalBorrowedAmount}{TotalBorrowedAmount + AvailableLiquidity}$$

The current interest rate of the protocol is expressed as an relationship against utilization rate as followed:

$$InterestRate(U) = \begin{cases} R_0 + \frac{U_t}{U_{optimal}} R_{optimal} & U < U_{optimal} \\ R_0 + R_{optimal} + \frac{U_t - U_{optimal}}{1 - U_{optimal}} R_{max} & U \geq U_{optimal} \end{cases}$$

where R_0 is the initial interest rate, $R_optimal$ is the optimal interest rate when when $U = U_{optimal}$ and R_{max} is the maximum interest rate.

1.5 Future Plan

Going forward, Port Finance aims to implement the following features:

- Leveraged trading using the Raydium AMM with one click, so user will be able to take a 3X long Solana Position with one click or a 3X short Serum Position with one click.
- Protocol to protocol lending to enable leverage yield farming

2 Fixed Rate Lending Protocol

In the next phase, Port Finance aims to build a fixed interest rate market using the Serum order book. This will provide two benefits:

- A fixed term & fixed rate product
- A more accurate and responsive interest rate discovery mechanism than bonding curve

Initially, Port Finance will provide a market for loans of 7 days. These loans can be extended or rolled into14-day, 21-day ones and so on. The platform will also introduce the pToken, a derivative token that corresponds one-to-one (it could switch to a variable relationship to charge less interest for early repayers) to the underlying loan. In addition, there will be a market for the pToken and the underlying tokens on the platform: USDC/pUSDC, SOL/pSOL, ETH/pETH, etc.

Borrowers are required to deposit assets and generate corresponding pTokens that they want to borrow according to a loan to value ratio. Concretely, if the borrower wants to borrow SOL, they will deposit assets and generate pSOL at a percentage discount of the collateral.

Lenders are required to go to the corresponding market to sell their assets and obtain the corresponding pToken. Once the loan maturity has been reached, they could then redeem the pToken for the underlying token (similar to loan repayment). Having a separate pToken eliminates the need to record the lending amount and period for each lender and borrower pair while also providing transferability and composability of loan ownership.

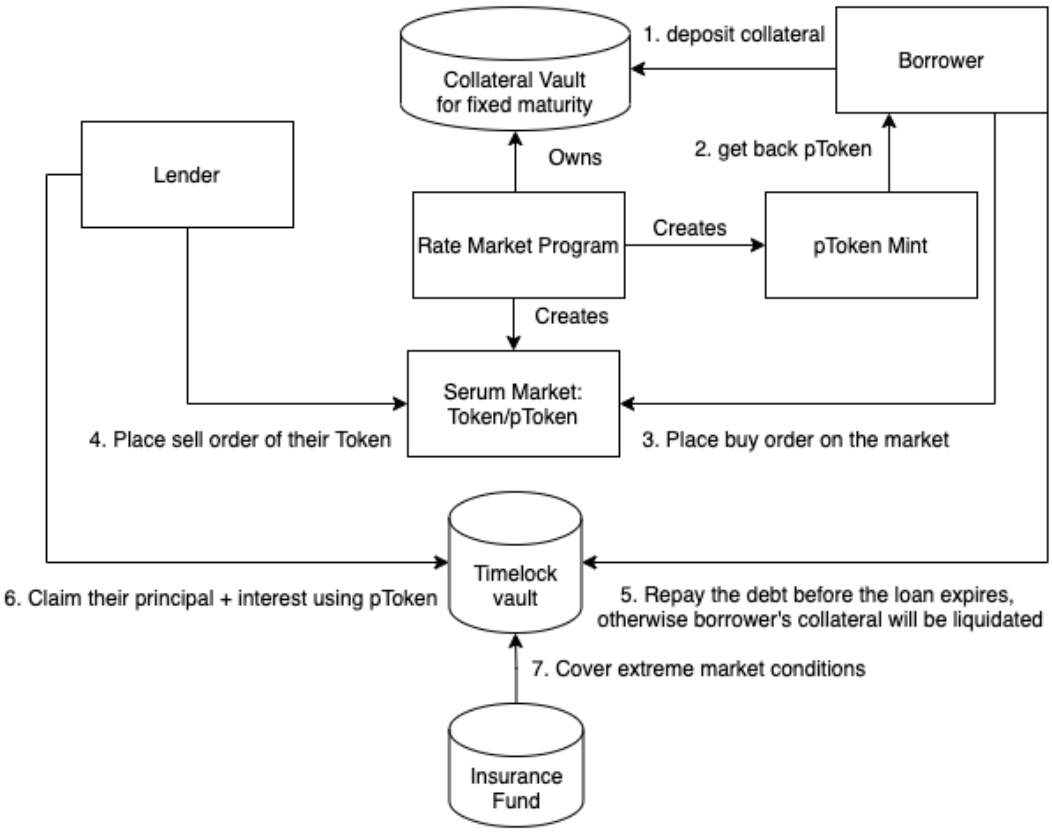
An interest rate market for USDC/pUSDC order book could look something like:

Size	**Rate**	
1000 USDC	1.00020 pUSDC	0.020% 7 day fixed rate
1000 USDC	1.00015 pUSDC	0.015% 7 day fixed rate
1000 USDC	1.00010 pUSDC	0.010% 7 day fixed rate
200 USDC	1.00050 pUSDC	0.005% 7 day fixed rate
800 USDC	1.00040 pUSDC	0.004% 7 day fixed rate
1000 USDC	1.00030 pUSDC	0.003% 7 day fixed rate

An example of an interaction might look like:

On UTC 00:00 1st of January, the market goes live and the trading period will be valid for the duration between UTC 00:00 to UTC 23:59 1st of January. The lenders place ask orders to sell their USDC in exchange for pUSDC, an entitlement to receive their principal plus interest. The borrowers place bid orders to obtain the loan at a desired interest rate. The protocol will identify the total amount that needs to be repaid before UTC 00:00 9th of January by checking the total supply of the pToken within a given lending period.

Each borrower will have an account denoting their borrow amounts. If borrowers have not repaid their loan amounts by the end of the designated lending period, third party liquidators can come in and liquidate the borrowers by repaying their loans and seizing their collateral at a discount.



3 Interest Rate Swap Protocol

Ultimately, Port Finance aims to implement an interest rate swap market between fixed rates and floating rates. In essence, fixed rate lenders would like to achieve the highest rates possible so that they can get the highest guaranteed yield, while floating rate lenders want to have the lowest rates possible so that they can profit once the variable rate rises more than the fixed rate. This relationship is similar to a buyer and seller in a central limit order book (CLOB) where the buyer is the floating rate lender (who wants the lowest fixed rate) and the seller is the fixed rate lender (who wants the highest fixed rate). Port Finance can create such a marketplace using the Serum matching engine.

As an example, if Alice wants to obtain a fixed yield with her 1000 USDC, she will do the following:

1. Deposit 1000 USDC into the protocol and obtain 1000 fixed rate tokens (for the specified maturity and start date) and 1000 pending pool tokens.
2. Alice will then place an ask order in the FIXED/FLOAT market. From here, there could be two outcomes:
   (a) Alice's order executes immediately, which results in her obtaining some amount of FLOAT tokens. Immediately afterward, she would send instructions to the derivative protocol to record this trade at the given interest rate (price in the original Serum sense).
   (b) Alice's order is not executed immediately. At a later time the float side comes and matches her order.
3. Either way, we assume that her 1000 fixed rate tokens receive 40 floating rate tokens, effectively a fixed 4% rate. After the lending reaches maturity, Alice will then receive 1040 USDC (which is the summation of 1000 fixed rate token plus 40 float rate token).

On the other side, we also have Bob who deposits 40 USDC and wants to long the interest rate:

1. Bob deposits 40 USDC into the protocol and obtains 40 fixed rate tokens and 40 pending pool tokens.
2. Bob then places a bid order in the FIXED/FLOAT market, and similarly there could be two scenarios, the first one being that it executes immediately and

the second that it executes some time later. Ultimately the key is to allow the interest rate protocol to record the agreed upon amount and rate.

3. We assume that he receives 1000 FIXED in return for his 40 FLOAT deposit. In the end, he receives the total amount of the money pool minus the fixed rate yield part as a proportion of his total amount of FIXED plus 40 pending pool tokens.

The interest rate protocol needs to record the following states (i.e. there needs to be an account for this) for any bond of a given maturity:

- Total pending tokens, i.e. the total amount of principal for the bond. Note that this does not equal total supply of pending tokens, as the below needs to sum up to the above.
- Total fixed token.
- Total float token.

The float side get $\frac{\text{(the total asset after maturity - total pending)} \times \text{(float+pending)}}{\text{total pending}}$.

4 Port Token

Port Finance will issue a platform token named PORT to enable decentralized community governance and incentivize early stage users.

4.1 Value Accruement

The PORT token accrues value by:

1. Acting as a governance token to decide on the various parameters of the protocols including the maximum loan to value ratio, which assets to support and also liquidation threshold and other changes related to the protocols.
2. Sharing protocol borrowing fees and also flash loan fee once the staking program has been set up.

4.2 Port Token distribution:

Total Supply: 100 million.

- **Ecosystem**: 33%.
- **Liquidity Incentives**: 31%.
- **Team**: 20% .
- **Fund raising**: 10%
- **Initial Liquidity**: 4%.
- **Advisors**: 2%.